MONITORING SYSTEM WITH CALL CENTER LAYOUT AND DESIGN CAPABILITIES

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MONITORING SYSTEM CLIENT WITH CALL CENTER LAYOUT AND DESIGN CAPABILITIES

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of U.S. Patent Application Serial No. 08/940,549, "Monitoring System Client For A Call Center," filed September 30, 1997, now pending.

TECHNICAL FIELD

The present invention relates generally to telecommunications systems and, more particularly, to a computerized call center layout tool for use with a call center monitoring system.

BACKGROUND OF THE INVENTION

A typical call center includes a number of agents who field inbound telephone calls and place outbound telephone calls. Each agent has an associated station that includes a personal computer or workstation, a phone pad and a head set. The agent may place outbound sales calls or field inbound calls (such as 800 number calls) from potential customers. The agents are organized into groups, and the agents have supervisors, who are responsible for supervising the agents. Each agent may receive or place calls for different business clients.

One of the difficulties encountered in such a call center is the difficulty of monitoring the phone activity of the agents. It is difficult for a supervisor to obtain useful information about the activities of agents in a timely fashion. Such a lack of information makes it difficult for a supervisor to properly manage the agents and increase the profitability of the call center. In general, a supervisor must perform manual analysis and calculation to obtain useful data regarding agent performance. The frequency with which the physical layout within a call center changes and the high turnover rates among the agents within a call center further complicate a supervisor's analytical activities. Additionally,

it is difficult to construct the layout of the call center, whether the call center layout is being revised or newly established. Further, it is difficult for a call center manager to monitor activities of related agents, adjacent stations, etc.

SUMMARY OF THE INVENTION

The invention addresses the limitations of the prior art by providing a computerized call center layout tool that facilitates constructing and updating a computerized model representing a call center's physical and logical structures. A computerized monitoring system utilizes the computerized call center model in monitoring the call center's agents. The monitoring system may display status information and statistics regarding agent activity superimposed over a graphical depiction of the call center model.

The call center layout tool provides a first tool set, comprising a graphically depicted toolbox including icons. The icons in the first tool set represent call center components such as agent workstations and cubicles. The call center layout tool provides a second tool set that permits a call center layout builder to access rapidly and to position intuitively the call center components on a map. Using the first and second tool sets, the builder constructs or updates a model of the call center's physical and logical structures. The call center layout tool provides a third tool set that allows the builder to link the call center physical and logical structures together to complete the call center model. While layout design tools exist, for example, drag and drop drawing programs by Visio Corporation, such programs fail to provide logical structures, as well as links to other data, excluding statistical data.

The call center layout tool enables multiple builders to construct a call center model cooperatively and to construct the call center model from remote locations. The call center layout tool allows builders to perform a data integrity check on the call center model using a call center data repository that includes call center information such as data regarding call center agents. The

call center layout tool further allows builders to save call center models and update the call center model as changes occur within the call center.

The monitoring system enables a supervisor to view information regarding all of the agents under supervision. The monitoring system may use the call center model to graphically display status and statistical data regarding call center agents. The supervisor may elect to alter the present arrangement of agents in the call center based upon agent performance information received from the monitoring system. The call center layout tool allows the supervisor to update the call center model to reflect changes in the call center.

The invention further provides a method for constructing a computerized model of a structure. A first graphical workspace is displayed upon which a builder may construct or update a computerized physical model of at least a portion of the structure. A second graphical workspace is displayed upon which a builder may construct or update a computerized logical model of at least a portion of the structure. The computerized logical model represents logical relationships within the structure. A first tool set is generated and displayed comprising at least one component of the structure. A second tool set configured to place and to manipulate at least one component on the first and second graphical workspaces is generated and displayed for construction of the computerized physical model of the structure and the computerized logical model of the structure. The computerized physical model of the structure and the computerized logical model of the structure are linked to form the computerized model. The resulting computerized model is formatted for display.

In accordance with another aspect of the invention, a method for constructing a call center is provided. In this method, a first computerized model is built representing physical structures in the call center. The first computerized model includes call center components such as agent stations. A second computerized model is built representing logical relationships within the call center. The second computerized model includes identification data for call

center agents. The first and second computerized models are linked together to form a computerized call center model.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the present invention will be described below relative to the following figures.

Figure 1 is a block diagram of a portion of a telecommunications system that is suitable for practicing a preferred embodiment of the present invention.

Figure 2 provides an illustrative embodiment of the call center layout tool of the invention.

Figure 3 depicts a transport object linking together two call center models.

Figure 4 depicts a series of agent detail objects used to construct a detailed mode map.

Figure 5 is a block diagram that illustrates the supervisor/control workstation of Figure 1 in more detail.

Figure 6 depicts an object architecture that is suitable for practicing the preferred embodiment of the monitoring system of the invention.

Figure 7 shows a screen shot of a window produced by the monitoring system client that contains a complete call center view.

Figure 8 depicts a pop-up window that displays information about a business client.

Figure 9 depicts hot spots for navigating to display a bay view or pod view.

Figure 10 is a screen shot that depicts a window produced by the monitoring system client where a bay view is displayed that contains call statistics.

Figure 11 is a screen shot that depicts a window produced by the monitoring system client where business client information is displayed that contains call statistics.

Figure 12 is a screen shot that depicts a window produced by the monitoring system client that contains a pod view.

Figure 13 is a screen shot that shows a window produced by the monitoring system client wherein a supervisor view is displayed.

Figure 14 depicts a pop-up window that displays agent information.

Figure 15 depicts network ports for the call center layout tool.

DETAILED DESCRIPTION OF THE INVENTION

The preferred embodiment of the present invention provides a monitoring system for a call center. The monitoring system includes a call center layout tool for building and updating computerized models of the call center's physical layout and agent stations and a client application program that displays information regarding agent activity and call statistics on an intuitive user interface. The user interface depicts a computerized call center model, which has been built using the call center layout tool, and displays with the computerized call center model useful information about agents and calling activity. The client application program may provide different views of the computerized call center model. In particular, the client application program may display the entire call center, a single bay of the call center, or a single pod of the call center.

A builder constructs a computerized call center model using the call center layout tool. The builder may be the call center monitor or any knowledgeable person having the appropriate authorization for accessing the call center layout tool. The call center layout tool provides the call center builder with a palette of graphical icons representing call center resources. These call center resources, which will be further described below, include agent stations, walls, and transports. By selecting icons and placing them on a map, the builder may create a computerized call center model that mirrors the physical layout of

the monitored call center and its agent stations. The call system monitor may then monitor the real-time performance of the call center by viewing the graphical display of the call center model.

The user interface of the related client application program displays information regarding each agent, including agent name, average handling time (AHT), average work time (AWT) and average talk time (ATT). Information regarding how many calls an agent has handled relative to a particular business client is also maintained. Graphical information is displayed to indicate whether an agent is available, unavailable, working on a call, or is in an error or unknown state. This graphical information may be overlaid on the computerized call center model that has been developed by the call center layout tool.

The client application program also displays statistical information regarding call types. For example, the statistical information may be displayed that specifies the number of outbound calls, the number of internal calls (*i.e.*, within the call center) and the number of inbound calls currently being handled. Statistical information may also be displayed regarding calls on a per business client basis. Statistics regarding how many calls were received for each type of business client that is being serviced by the call center may also be displayed. The statistics may be displayed in graphical format to provide a visual tool for analyzing activity within the call center. The statistical information may also be displayed in conjunction with the computerized call center model.

Figure 1 is a block diagram that illustrates a portion of a telecommunications network that is suitable for practicing a preferred embodiment of the invention. The telecommunications network includes a call center 10 that is connected to a public switched telephone network (PSTN) 12 via a voice trunk 14. Those skilled in the art will appreciate that the call center 10 may also be alternately connected to other types of networks from which calls may originate. The call center 10 includes an automatic call distributor (ACD) 16 or other switching mechanism for distributing incoming calls within the call center. The ACD 16 is connected via a voice trunk 18 to agent stations 20.

These agent stations 20 include a workstation or personal computer, a phone pad and a head set. Agents are stationed at the stations 20, and the agents utilize the resources contained therein to process calls. The ACD 16 is also connected via a voice trunk 22 to a voice response unit (VRU) 24. The VRU 24 automates call processing. The VRU 24 may be used to collect information such as account numbers, credit card numbers and service requests from a caller. The VRU 24 is connected to a computer/telephone integration (CTI) server 30 via a data link 26. The CTI server 30 extracts call data from the ACD 16. In particular, the CTI server 30 abstracts raw call data from the ACD 16 into useful statistical data. The CTI server 30 also distributes data in the form of events. The CTI server 30 may run as a separate process on a dedicated computer system. A suitable CTI server is the T Server produced by Genesys Labs of San Bruno, California. The CTI server 30 is connected to the ACD 16 via data link 28 and is connected to the agent stations 20 via data link 32.

CTI monitoring server (CTIMS) 36 is connected to the CTI server 30 via data link 34. The CTIMS 36 may be implemented on a dedicated computer or on a shared computer. The CTIMS 36 compiles statistical data that is collected from the CTI server 30 into useful data for presentation and management at the supervisor/control workstations 38. This data is utilized by the client application program of the preferred embodiment of the present invention, as will be described in more detail below. The CTIMS 36 registers with the CTI server 30 to receive all events that are output by the CTI server 30. Examples of events that are output by the CTI server 30 include events indicating calls received, calls routed, calls answered, and calls disconnected. The CTIMS 36 categorizes the events into groups, such as by agent, by supervisor, by call type, by business type and the like. The CTIMS 36 also calculates certain statistics such as average call handling times. A suitable implementation of CTIMS is described in copending application entitled, "Computer/Telephony Interface Monitoring Server," U.S. Application No. 08/940,547, which is explicitly incorporated by reference herein.

The CTIMS 36 is connected to an automated resource management system (ARMS) 44 via data link 46. The ARMS 44 provides management of resource data for the call center. The ARMS 44 is largely a database on a server that comprises interfaces for access by CTIMS 36 and supervisor/control workstations 38.

A call center builder uses a call center layout tool 50 to construct a computerized model of the physical layout of the call center. The call center layout tool 50, which may be a PC-based computer program, sends data representing the call center model to the supervisor control workstation 38 through data link 51. The call center layout tool 50 may also send data to the ARMS 44 and receive data from the ARMS 44 along link 51. In some embodiments of the invention, the call center layout tool 50 may link agent station 20 data from the ARMS 44 to the computerized call center model.

It should be appreciated that data links 26, 32, 34, 40, 42, 48, and 51 may all be implemented as local area network (LAN) connections. A suitable LAN is an Ethernet LAN.

Figure 2 provides an illustrative embodiment of the call center layout tool 50 of the invention. The call center layout tool 50 operates as a graphical user interface (GUI) application in this embodiment and provides a "What-You-See-Is-What-You-Get" (WYSIWYG) design tool for graphically constructing a computerized model of a call center. The computerized call center model may then be displayed on the supervisor/control workstation 38 in conjunction with the call center agent monitoring program described below. The call center layout tool's graphical design environment utilizes well-known graphical techniques such as drag-and-drop, rubber-banding, and stretchable controls (adjusting window size) as tools for modeling a call center. The call center layout tool 50 provides the builder with a multiple document interface (MDI) for concurrent modeling of an unlimited number of call centers.

As shown in Figure 2, the call center layout tool 50 provides a screen display 201 that is used by a builder to construct a call center model 219.

The builder selects icons from an icon palette 202 and places them on a map 203. The icon palette 202 comprises a first tool set that provides the builder with the components needed for constructing the call center model 219. The first tool set provides icons representing call center components, such as a cube 204, a wall 205, a transport 207, and an agent detail icon 208.

A cube icon, such as the cube 204, represents call center agent cubicles or workstations. When the builder selects the cube icon 204, the call center layout tool 50 enters a "cube mode" that allows the builder to place multiple cube objects 209 on the map 203. In the cube mode, the builder may place and manipulate the cube objects 209 by accessing an appropriate key, such as a mouse button. The builder's ability to place and manipulate call center components, such as the cube object 209, comprises a second tool set within the call center layout tool 50.

When the builder first places a cube object 209 on the map 203, the cube object 209 has no assigned properties. If the builder accesses an appropriate key, such as a right mouse key, the builder receives a message stating "no properties assigned" for the cube object 209. The builder may assign or modify properties of the cube object 209 at this time or later. Once properties have been assigned to the cube object 209, then when the builder accesses the appropriate key, the cube object's properties will be displayed. A cube object's properties include a logical workstation number (LWN) for the agent workstation. As described in detail below, the call center monitoring system uses the LWN to link statistics from the CTIMS 36 and properties from the ARMS 44 for a given Agent Station 20 with the cube object 209 that represents an Agent Station 20. The call center layout tool's ability to link the call center model 219 with other call center properties, such as agent properties, comprises a third tool set.

The builder may place and manipulate a wall object 210 in a manner similar to that which the builder emplaces the cube object 209. When the builder selects wall icon 205, the builder enters into a "wall mode" and may draw walls 210 on the map 203. Wall objects 210 represent barriers in the call center

and have no assigned properties, so the builder's task ends once he has satisfactorily placed the wall object 210 on the map 203.

The builder uses a transport icon 207 to link two different call center models. When the builder selects the transport icon 207, the builder enters into the "transport mode" and may place a transport object on the map 203 by accessing an appropriate key, such as a mouse button. The transport mode will be discussed below.

The builder selects an agent detail icon 208 for the map 203 in the same way as the other icons. When the builder selects the agent detail icon 208, the builder enters into the "agent detail mode." In the agent detail mode, the builder then assigns an LWN as a property to an agent detail object, as will be discussed below.

The builder uses a reposition icon 206 for moving a previously placed call center object to a new location on the map 203. When the builder selects the reposition icon 206, the builder enters into the "reposition mode" in which the builder may reposition any object on the map 203 by selecting it and dragging it to a new position. In the reposition mode, the builder may also select an object then engage an appropriate key, such as a right mouse button, in order to display the object's properties.

As shown in Figure 2, the screen display of the call center layout tool 50 presents the builder with additional tools for constructing the call center model 219. The builder may use a data lock icon 211 to specify that another builder has authorization for changing the map 203 while excluding other potential builders. The call center layout tool 50 provides the builder with a security mechanism which includes access rights for both editing and creating the call center model 219. Builders without the appropriate access rights may not alter the call center model 219.

The builder uses an agent icon 212 to search through the ARMS 44 database to locate a particular agent's name or to locate a specific LWN. The call center layout tool 50 also provides the builder with an option for

automatically checking the ARMS 44 database to locate updates to a call center model 219, or document files, subsequent to the loading of a particular call center model.

The builder uses a pencil icon 213 to modify the shape of a call center component, such as the wall 210. The pencil icon 213 enables the builder to accurately represent irregular shapes within a call center's physical layout such as a curve. In a similar manner, a hammer icon 214 may be used for making small modifications to a call center component, such as the wall icon 210. For example, the hammer icon 214 may be utilized by the builder to represent a small indentation in an otherwise smooth wall in the call center.

The builder may use a map icon 215 as a means for locating which portion of a large call center model is presently being displayed on the map 203. Thus, for very large call center models, the builder may only see a portion of the call center model 219 on the map 203 at any one time, but may visually reference the map icon 215 to determine which portion of the call center model 219 is presently displayed in the map 203.

A multi-function knife icon 216 may be utilized by the builder to modify various settings in the call center layout tool 50. For example, the builder may use the knife icon 216 to engage a "snap-to-grid" setting. The builder may also use the knife icon 216 to engage other functionality, such as a context-sensitive help function. The context-sensitive help function provides the builder with information about each of the icons and other tools provided for the builder's use in constructing the call center model 219.

The builder uses a flashlight icon 217 to illuminate or highlight a portion of the map 203. For example, the builder may wish to highlight the location of a call center manager's location. The builder may use a camera icon 218 to make a computerized snapshot of the call center model 219. The call center layout tool 50 stores the snapshot as a bit mapped object in one embodiment. The builder may print out the computerized snapshot to compare the computerized call center model 219 against the physical call center or may

send copies of the snapshot to call center management or other supervisory personnel.

When the builder has completed the call center model 219 on the map 203, he assigns the call center model 219 to an actual call center by selecting a call center name from a list box. The call center layout tool 50 then stores the call center model 219 as a document file on the supervisor/control workstation 38.

The builder may next select an "apply to production database" option provided by the call center layout tool 50. This option causes the call center layout tool 50 to copy the document file to the ARMS 44 database and perform a data integrity check. The data integrity check matches the call center to which the document file is assigned to a table of LWNs for the call center stored in the ARMS 44. The integrity check ensures the validity of all LWNs assigned to cubes 209 in the document file for the call center and also ensures that the builder has assigned each LWN for the call center to a cube 209 in the document file.

Microsoft Visual C++ 4.2 and the Microsoft Foundation Classes (MFC) have been used to encode the software for the call center layout tool 50. The MFC architecture simplifies incorporation of advanced Windows features such as print preview, floating dockable toolbars, context-sensitive help and property pages. Of course, the call center layout tool 50 may be built using any one of a variety of programming systems known to those skilled in the computer modeling arts.

One embodiment of the call center layout tool 50 operates on all 32-bit Microsoft operating systems, such as Windows 95, Windows NT 3.51, and Windows NT 4.0. An Intersolve Oracle V7.0 ODBC driver provides the call center layout tool 50 with access to the ARMS database 44. The call center layout tool 50 may be designed to operate on any computing system known to those skilled in the art of computer programming. An exemplary embodiment of

the call center layout tool 50 may be constructed without third party OLE controls.

In an alternate embodiment, the call center layout tool 50 uses MFC TCP/IP sockets to allow one or more distributed builders to simultaneously edit the same call center model, with each builder viewing the actions of the other builders in real time. For example, a call center may be cooperatively constructed by builders representing each of the call center's initial customers. Thus, each builder may contribute to the construction of one call center model. In another alternate embodiment, the builder may remotely access the call center layout tool 50 to construct a new call center model or to update an existing call center model. As shown in Figure 15, remote access to the call center layout tool 50 may be provided through a mechanism such as network ports 1501.

Figure 3 depicts a transport object linking two call center models together. When the builder selects the transport icon 207, the builder enters into the "transport mode" and may place a transport object 301 on the map 203 by accessing an appropriate key, such as a mouse button. Transport objects 301 represent both physical and logical connections between parts of a call center. For example, the transport object 301 may represent physical connections between portions of a call center, such as a stairway or passageway. On the other hand, the transport object 301 may represent a logical connection between portions of a call center, such as two portions of a call center that are both dedicated to a single customer. The transport object's main property is a destination map, or the location of another call center model to be linked to the call center model 219 on the map 203. The builder accesses a transport object property window 302 through an appropriate key such as a right mouse key.

The builder stores call center models in a document file. After placing the transport object 301 on the map 203, the builder then assigns to the transport object property window 302 the name of another destination map, which may represent another call center, another floor of the same call center, another section of the same call center floor, a detailed mode map, or any other

type of map. In an exemplary embodiment, the destination map assignment property for the transport object property window 302 comprises a pointer to the document file that comprises the other call center model. Thus, the transport object 301 creates a pointer between the document file for the call center model 219 on the map 203 and the document file for another call center model. As will be discussed later, a user may view the other call center model by accessing appropriate keys, such as a double click on a mouse.

The builder may construct call center models on several maps 203 and then link those call center models together with transport objects 301. The map 203 may include multiple links through transport objects 301. This procedure may be helpful when the call center supervisor has two groups of agents located in two different call centers that both serve the same customer. In this situation, the call center supervisor may view performance data for both groups of agents together by utilizing a transport object 301 that links the two call center models together.

Figure 4 depicts a series of agent detail objects used to construct a detailed mode map 403. The builder selects an agent detail icon 208 in the same way as the other icons. When the builder selects the agent detail icon 208, the builder enters into the "agent detail mode" and may then place an agent detail object 401 on the map 203 by accessing an appropriate key, such as a mouse button. Agent detail objects 401 comprise information pertaining to specific agents within the call center.

To enter information for an agent represented by a particular agent detail object 401, the builder accesses an appropriate key, such as a right mouse click, which invokes an agent detail window 402. The builder may enter an agent's name and assign an LWN as a property of the agent detail object 401 by entering the appropriate information in the agent detail window 402. The builder may place agent detail objects 401 on the map 203 and assign LWNs to those objects in addition to placing cubes, such as cubes 209 of Figure 2, on the map 203 to represent agents. By placing agent detail objects 401 on the map 203, the

builder constructs the detailed mode map 403 for the call center. The detailed mode map 403 includes logical information regarding the call center, such as agent status information, and complements the physical call center information in the call center model 219. The builder may then link the physical call center model 219 to the detailed mode map 403 using a transport 207.

The detailed mode map 403 is discussed in greater detail below with reference to Figure 10. In general, when a user accesses an appropriate key, such as a right mouse click, the agent detail icon 401 displays performance statistics for its respective LWN, such average handling time (AHT), average work time (AWT), and average talk time (ATT). The ARMS 44 prepares these statistics and includes the name of the agent presently assigned to the LWN.

Figure 5 depicts the format of a suitable supervisor/control workstation 38 for practicing the preferred embodiment of the present invention. The supervisor/control workstations 38 are the personal computers or workstations that are used by the agent supervisors. The workstation 38 includes a central processing unit (CPU) 53 for overseeing operation of the workstation. The workstation 38 may also include a number of peripheral devices, including a keyboard 52, a mouse 54 and a video display 56. A modem 58 may be included for enabling the workstation 38 to communicate with remote computing resources over conventional telephone lines. A network adapter 60 may be included to enable the workstation 38 to be connected to a local area network. The workstation 38 includes both primary memory 64 and secondary storage 62. The primary memory 64 may hold a number of different types of data and programs. These programs may include an operating system 66 and a client application program 68 that is responsible for providing a graphical user interface (GUI) to the user of the workstation 38 to display information regarding call center activity. The application program 68 retrieves the computerized call center model, such as the call center model shown in Figure 2, and overlays additional call center information on this model. The client application program

68 is known as the monitoring system client. The secondary storage may hold data 70 that is used by the monitoring system client.

Those skilled in the art will appreciate that the call center 10 may have a different configuration than that depicted in Figure 1. Those skilled in the art will also appreciate that the workstation depicted in Figure 5 is intended to be merely illustrative and not limiting of the invention. The invention may be practiced with different call center configurations and workstation configurations.

In an alternate embodiment, the call center design tool 50 may be included as an optional series of commands on the client application program 68.

Before reviewing operation of the monitoring system client 68 in more detail, it is useful to review how calls are processed by the call center. Initially, a call originates from the PSTN 12 and is sent over the voice trunk 14 to the ACD 16. The ACD 16 decides where the call should be sent. The call is routed over voice trunk 22 to the VRU 24. The VRU 24 includes voice messages for obtaining information from the caller. As was mentioned above, the VRU 24 may collect information such as account numbers, credit card numbers and service requests. The gathered information is passed over the data link 26 to the CTI server 30. The CTI server 30, in turn, passes the data to the agent workstation 20 that will be servicing the call. The ACD 16 then switches the call to the agent station 20 that is to handle the call. An application may be run on the agent workstation to provide a screen pop with the information that has been collected by the VRU 24 so that the agent at the agent station 20 has the collected information available. The agent accepts the call and processes it accordingly. Additional information about the caller may be retrieved from ARMS 44.

As was mentioned above, the ACD 16 outputs information regarding the routing and processing of calls over data link 28 to the CTI server 30. The CTI server 30 outputs events that are received by CTIMS 36 over data link 34. These events are processed and categorized by CTIMS 36 and sent over data link 40 to the monitoring system client 68. The monitoring system client 68

uses this information to generate the GUI on the video display 56 to help the supervisor monitor activity within the call center. The GUI will be described in more detail below.

It should be appreciated that the monitoring system client 68 receives two types of information from the CTIMS 36. Sockets, such as found in the UNIX operating system, are used for interprocess communication between the monitoring system client 68 and CTIMS 36. A separate socket is provided for each type of information. The first type of information is state change information that indicates a change in the state of an agent. An agent may generally be in one of the following states: unavailable, available, call work, on call, error or unknown. When the agent is in an unavailable state, the agent is not available for processing calls. When the agent is in an available state, the agent is not currently processing a call and is available to process calls. When the agent is in the on call state, the agent is handling a call. When the agent is in the call work state, the agent is done handling a call but is working on the call data. When the agent is in an error state, an error has occurred. An agent also may be in an unknown state. The system also monitors call type. Examples of call type are outbound call, conference call, internal call or business call (wherein the business is known).

When an agent changes states (*e.g.*, completes a call), CTIMS 36 sends an event that specifies the change in state. For example, if an agent changes from being unavailable to available, CTIMS 36 generates an event that is sent to the monitoring system client 68.

The CTIMS 36 also provides a second type of information: statistical information. This statistical information is used by the monitoring system client 68 and is displayed as part of the GUI produced by the monitoring system client. For purposes of efficiency, the statistical information is not continuously fed to the workstation 38; rather, the monitoring system client 68 polls CTIMS 36 on a periodic basis (such as every 5 seconds) to receive updated

statistical information from the CTIMS. The monitoring system client 68 includes code for receiving the statistics and updating information accordingly.

The monitoring system adopts an object-oriented architecture. Figure 6 illustrates a number of the object classes that are utilized within this architecture. Business objects are provided for each business client that is being serviced by the call center. The business objects are of the business object class 74. Agent objects are created for each agent within the call center. The agent objects are of the agent object class 76 and hold information regarding specific agents in the call center. The agent objects may hold information regarding the identity of the agent, the supervisor of the agent, telephone information for the agent, statistical information regarding the agent, state information regarding the agent and the identity of businesses for which the agent may process calls. Information regarding supervisors of agents is stored in the objects of the supervisor object class 78. Each call center may have an associated center object of the center object class 82.

The group object class 80 is provided and serves as an abstract base class from which classes can be derived to maintain statistical information pertaining to a defined group of agents. Each group may have an associated object of the group object type 80. Each center object holds information regarding the associated call center.

The CTIMonitor object class 84 is for objects that are responsible for receiving and broadcasting information from and to the CTI server 30. This information may include agent user IDs and passwords, directory numbers assigned to agents and phone pads used by agents. The config object class 88 is for objects that maintain configuration information. Each socket has an associated instance of the IS ("intelligence service") object class 89. These sockets are used to communicate with instances of the monitoring system client that are of the UA ("user agent") object class 91.

The ARMS 44 maintains information regarding the agents, supervisors, and business information. The ARMS 44 may also include call

center model information, such as that shown in Figure 2. As was mentioned above, this information is encapsulated into objects of different object classes. In particular, agent information is encapsulated into instances of the agent object type 76, information regarding supervisors is encapsulated into instances of the supervisor object type 78 and business information is encapsulated into objects of the business object type 74. The CTIMS 36 maintains information about these objects and passes this information along with the statistical data to the monitoring system client 68 around on the supervisor/control workstations 38.

The monitoring system client 68 generates a GUI that depicts a portion or all of the call center model. The call center layout tool 50 has prepared the display of the call center shown. The monitoring system client 68 may retrieve information regarding the computerized call center model. The monitoring system client 68 is also aware of what agents are currently processing calls in the call center and where the agents are stationed based upon information retrieved from the ARMS 44. The monitoring system client 68 additionally maintains statistical information regarding agents, supervisors and business segments. This information is utilized by the monitoring system client 68 to display appropriate information in the GUI.

The GUI generated by the monitoring system client 68 may display a number of different views of the call center model created by the call center layout tool 50. The call center is composed of a number of bays. Each bay typically includes two pods, and each pod includes a number of agent stations. The GUI may display an entire call center view, a bay view, or a pod view. Each of these views displays a different respective portion of the call center. These views allow a supervisor to view the entire call center or to focus on particular portions of the call center that are of interest.

Figure 7 depicts an example window 90 that is generated by the monitoring system client 68. The window 90 includes a statistics section 92 that displays statistics regarding calling activity and a call center section 94 that has a graphic layout taken from the computerized call center model. Agent stations are

depicted as rectangular buttons 100 in Figure 7. Each button may display an icon that indicates the agent state, call type or business type. For example, rectangle 110 holds an icon that provides a visual cue that the agent is unavailable. Rectangle 111 holds a letter (*e.g.*, "O") that indicates that an outbound call is being processed by the agent at the associated agent station. Rectangle 112 holds an icon that indicates that the business client for which the agent is servicing a call. In general, if an agent is in the available state, the unavailable state or the error/unknown states, the icon associated with that state is displayed in the rectangle associated with the agent. If the agent is placing an outbound call, an internal call or an unknown call, the letter associated with that type of call is displayed in the rectangle for the agent. If the agent is processing a call that is associated with a given business, the icon for the business will be displayed in the rectangle for the agent. Those skilled in the art will appreciate that other types of activatable user interface elements, other than buttons, may be used to depict agent stations.

The statistics section 92 of the window 90 holds various statistics regarding calling activity within the current view. The state table 114 of the statistic section 92 specifies the number of agents that are currently available, unavailable, processing calls or in an error or unknown state. The percentage of these totals is also displayed. The call type area 116 displays statistics by call type. The number of outbound calls, the number of internal calls, the number of unknown calls and the number of consulting calls are all totaled and displayed within the call type area 116.

The business type area 118 of the statistics section 92 displays information regarding calls by business type. The icon associated with the business client and the name of the business client are displayed along with the total number of calls processed for the business, the current number of calls being processed for the business and percentages.

Summary statistics may also be displayed in the statistics section 92. For example, statistics 117 regarding the number of agents currently logged

on in the call center and statistics 119 indicating the number of agents that are currently processing calls may be displayed.

Window 90 may also include a section 124 that holds call center statistics such as the number of abandoned calls, the number of ghost calls, the number of hang-ups and the number of calls handled. Graphical information 122 may also be displayed that shows the percentage of agents that are either on call, unavailable, available or call work.

The window 90 includes a menu bar that holds an entry 120 to access a view menu. The view menu enables a user to alter the view displayed within the window 90. As will be described in more detail below, the user may request the displaying of a call center view, a bay view, a pod view or a supervisor view.

The monitoring system client 68 also enables certain pop-up windows to be displayed. One of these pop-up windows is a window regarding information that is particular to a given business client. If a user positions a mouse cursor over the entry for the business type within the statistic section 92 and clicks, a pop-up window for the business client is displayed. Figure 8 shows an example of such a pop-up window 126. The pop-up window 126 holds information that identifies the business client and holds summary statistics regarding calls processed for that business type. These summary statistics may include the number of agents on call for the business, calls in the queue that are waiting for an agent, abandoned calls, ghost calls, hang-up calls, handled calls and available agents.

As was mentioned above, a user may activate the view menu to change to the view displayed within the window 90. The user may also change the view by positioning a mouse cursor at locations within a section of the view displayed within the window 90 and clicking a mouse button. Figure 9 identifies the hot spots within the depiction of the call center that may be used to change the view from a call center view to a bay view or a pod view. Figure 9 shows the depiction of a bay 132 and indicates that positioning a mouse cursor in proximity

to the area pointed to by arrow 134 and clicking results in a bay view being displayed within the window 90. If, however, a user positions a mouse cursor to point to the hot spots indicated by arrows 136A or 136B and clicks, a pod view for the pod associated with a respective hot spot is displayed within the window 90.

Figure 10 shows an example of a bay view. The bay view may either hold statistical information or business client information. In Figure 10, the bay view holds statistical information. As can be seen in Figure 10, the entire call center model is not displayed within the window 90 but rather only a single bay 140 is depicted within the window 90. The statistics section 92 holds information only as to activity relative to the bay that is shown. Information 142 regarding each agent within the bay is shown. This information includes the name 150 of the agent and an icon 152 on a button that indicates either the state of the agent, the call type or the business type. This icon is like that found for agents in the call center view. A set of statistics 154 is also displayed for each agent. The statistics include the average handling time (AHT), which specifies the time it takes on average for an agent to handle (*i.e.*, fully process) a call. The statistics 154 also include the average work time (AWT), which identifies the time at which the agent is processing the call but not talking, and the average talk time (ATT), which specifies the average amount of time that the agent is talking on a call. The AHT is the sum of the AWT and ATT.

Graphical data 148 depicting the percentage of agents that are on call, unavailable, available or in an error state is depicted within the bay view. The bay view also includes a condensed view 144 of the call center. The bay 146 currently being displayed is highlighted in the condensed view 144 to indicate position of the bay within the call center. A "Business" button 156 may be displayed and activated to change the view to show business segment information for the bay rather than call statistics for the bay.

Figure 11 depicts an example of an instance wherein the business client information is shown for a bay view. Graphical data 148 and a condensed

view 144 of the call center layout are still displayed. Similarly, the statistics section 92 holds statistical information regarding calling activity for the bay. The information that is displayed per agent, however, differs. The name 170 of the agent is still displayed but only information regarding business clients are displayed. In particular, an icon identifying a business client and the associated number of calls that have been processed for the business client are displayed. For example, icon 166 is associated with the first business and the display shown in Figure 11 indicates that nine calls have been processed by the given agent for that business. Icon 168 is associated with a different business and the display indicates that only a single call has been processed by the agent for that business. The window 90 may include a "CallStats" button 164 that may be activated to show call statistics information for the bay view rather than business client information.

As was mentioned above, the view may also show only a single pod (*i.e.*, half of a bay). Figure 12 depicts an instance wherein a pod view for a pod 182 is displayed. The information is like that shown for the bay view but includes only information for the agents within the given pod. The statistics section 92 holds information for the pod and the graphical data 148 is for the pod. The condensed view 144 of the call center model shows a highlighted section 180 that is associated with the pod. As in the bay view, a user may choose to show call statistics information or business client information for the agents. A "Business" button 184 may be activated to toggle to the business segment information for the pod.

A supervisor view for a given supervisor may also be displayed (see Figure 13). The supervisor view shows a statistic section 92 that holds statistics for the agents under the supervisor. A graphical section 500 shows statistics regarding each of the agents. The information includes the name 502 of the agent and a phone identifier 503 for the agent. A table of call information is displayed that includes a column 504 that may hold icons 506 for the given business client, a column 508 that identifies the total number of calls processed

by the agent for the business and the average talk time (ATT) for the calls processed for the business. Totals 512 for the table are displayed as well. Statistics 514 regarding the average working time (AWT) are displayed along with statistics 516 for the average handling time (AHT). The percentage of time which the agent is unavailable 518 is displayed along with the percentage of time the agent is available 520.

It should be appreciated that in any of the views, information regarding an agent may be obtained by positioning a mouse cursor over the button (*i.e.*, rectangle) associated with an agent in the given view and activating the button by clicking a mouse button. Figure 14 shows an example of an agent view window 240. The name 241 of the agent is displayed in the title bar of the window 240. The social security number 242 of the agent may be displayed along with a phone identifier 244. The total time in which the agent has been logged in 246 is displayed. The name of a supervisor 248 is displayed as well. A table summarizing call processing for the agent by business segments is displayed. Each row 250, 252 and 254 holds information about the associated business segment. The total number of calls and the average time to handle a call are displayed within the associated row. The total amount of time spent on handling calls for the business are also displayed.

The window 240 includes a table 256 that summarizes how much time the agent has spent in a respective agent state. The window 240 also includes a graph 258 that shows the number of calls processed by the agent by business segment and a graph 260 that shows the time in which an agent has been in the respective agent states is included in the window 240. Lastly, a "Close" button 262 is provided to enable the pop-up window 240 to be closed.

The present invention has the benefit of enabling a supervisor or other party to view information regarding call processing activity within the call center. The supervisor may readily change the view as needed and information contained within the views is updated regularly to be ensured to be current.

Moreover, the information is shown in a variety of different formats that are useful to a supervisor.

While the present invention has been described with reference to a preferred embodiment thereof, those skilled in the art will appreciate that various changes in form and detail may be made without departing from the intended scope of the present invention as defined in the appended claims. For example, the user interface may differ from that shown in the figures. Moreover, the monitoring system client may be run on agents workstations or other workstations that differ from the supervisor/control workstations. Still further, the monitoring system client may be run at a remote computer outside of the call center.

The computerized call center layout tool of the invention may be applied in connection with systems and methods for call center monitoring. As already stated hereinabove, the present application is a continuation-in-part from a patent application entitled, "Monitoring System Client For A Call Center," of U.S. Patent Application Serial No. 08/940,549, filed September 30, 1997, and assigned to a common assignee. In addition, a suitable implementation of the CTIMS used in accordance with the invention is described in copending application entitled, "Computer/Telephony Interface Monitoring Server," U.S. Application No. 08/940,547.

Further aspects of the present invention are described in the following copending patent applications, each of which is assigned to a common assignee: U.S. Application No. 08/940,546, "Monitoring System For Telephony Resource In A Call Center," filed September 30, 1997; U.S. Application No. 08/934,167, "Desktop Telephony Application Program For A Call Center Agent," filed on September 19, 1997; U.S. Application No. 08/934,166, "Telephony Server Application Program Interface (API)," filed on September 19, 1997; U.S. Application No. 08/940,548, "Automated Resource Management System (ARMS) For Call Center," filed on September 30, 1997; U.S. Application No. 08/933,767, "Configurable Application Program For Call Center

Sales and Services," filed on September 19, 1997; U.S. Application No. __________, "Data Archiving Of Call Data In Call Center," filed on __________, and U.S. Application No. __________, "Failover Mechanism For Computer/Telephony Integration Monitoring Server," filed on __________.

Although specific embodiments of, and examples for, the invention are described herein for illustrative purposes, various equivalent modifications are possible within the scope of the invention, as will be recognized by those skilled in the relevant art. The teachings provided herein of the invention may be applied to other modeling systems, not necessarily the exemplary computerized call center layout tool for call center monitoring systems described above. Various exemplary computing systems, and accordingly, various other system configurations can be employed under the invention.

The embodiments of the invention disclosed herein have been discussed with regard to computerized call center installations, such as those using large centralized computing systems. However, the invention finds equal applicability in other computing systems, such as small, portable computerized graphics tablets and other hand-held computing devices.

All of the above U.S. patents and applications are incorporated herein by reference. While the invention focuses on modeling physical elements within a telephone call center, the invention can similarly operate with regard to modeling physical elements within other types of structures, including other types of building structures and mechanical devices.

These and other changes can be made to the invention in light of the above detailed description. In general, in the following claims, the terms used should not be construed to limit the invention to the specific embodiments disclosed in the specification and the claims, but should be construed to include all computerized layout tools and computerized design tools that operate under the claims to provide a method for guiding a builder through the process of constructing a computerized model of a structure, providing rapid access to data associated with objects in the structure, and linking objects between structures.

Accordingly, the invention is not limited by the disclosure, but instead its scope is to be determined entirely by the following claims.